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ILLINOIS NATURAL HISTORY SURVEY

BIOLOGICAL AND SOIL SURVEY OF FAP 412 FROM OGLESBY,
LASALLE COUNTY TO BLOOMINGTON, MCLEAN COUNTY, ILLINOIS
COMPONENT 2.4: CHIROPTERA

FINAL REPORT

15 July 1985

Section of Faunistic Surveys and Insect Identification Technical Report

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by
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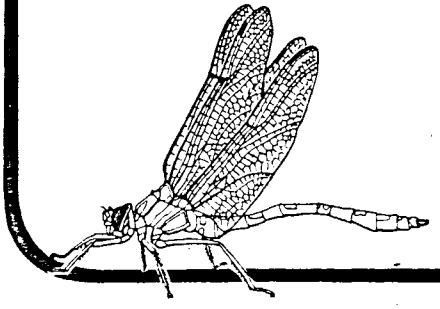

For
Illinois Department of Transporation
Bureau of Locations and Environment
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Springfield, Illinois 62764

TABLE OF CONTENTS

PAGE

LIST OF FIGURES iii

LIST OF TABLES iv

INTRODUCTION 1

DESCRIPTION OF STUDY AREA 1

METHODS AND MATERIALS 10

Vegetation Analysis 10

Live Trapping Bats 10

RESULTS 12

DISCUSSION 18

Historical Records 18

Federal and State Endangered Chiroptera in Illinois 19

Sampling Biases 23

Elements of Quality Bat Habitat 24

Federal and State Endangered Chiroptera in the FAP 412 Study Area 25

ACKNOWLEDGEMENTS 26

LITERATURE CITED 27

LIST OF FIGURES

Figure — Page

1. Location of four mist netting sites in the FAP 412 study area, Mackinaw River, McLean and Woodford counties, Illinois..... 3

2. Location of MRDS 6 netting site, FAP 412 study area, Mackinaw River, Woodford County, Illinois..... 4

3. Location of Golf Course netting site, FAP 412 study area, Mackinaw River, McLean County, Illinois..... 5

4. Location of MRC 5 netting site, FAP 412 study area, Mackinaw River, McLean County, Illinois..... 7

5. Location of Koon's Ford netting site, FAP 412 study area, Mackinaw River, McLean County, Illinois..... 9

LIST OF TABLES

Table — Page

1. Vegetation classification and stream characteristics of netting site MRDS 6, FAP 412 study area, Woodford County, Illinois..... 12

2. Bat capture data for MRDS 6 netting site, FAP 412 study area, Woodford County, Illinois..... 13

3. Vegetation classification and stream characteristics of the Golf Course netting site, FAP 412 study area, McLean County, Illinois..... 14

4. Bat capture data for Golf Course netting site, FAP 412 study area, McLean County, Illinois..... 15

5. Vegetation classification and stream characteristics of the MRC 5 netting site, FAP 412 study area, McLean County, Illinois..... 16

6. Vegetation classification and stream characteristics of the Koon's Ford netting site, FAP 412 study area, McLean County, Illinois..... 17

7. Bat capture data for Koon's Ford netting site, FAP 412 study area, McLean County, Illinois..... 17

8. Records of occurrence for bat fauna from the FAP 412 study area, McLean, Woodford, and adjacent counties, Illinois..... 18

INTRODUCTION

Environmental assessments for endangered and threatened flora and fauna are conducted at Illinois Department of Transportation (IDOT) project areas upon request by that agency. The objective of these studies, part of a state-wide biological survey and assessment program conducted by the Illinois Natural History Survey (INHS), is to identify federally listed endangered and threatened species likely to be affected by IDOT highway construction projects. The Bureau of Locations and Environment (IDOT) wishes to consider in a similar fashion those species listed as endangered and threatened in Illinois, as defined and identified by the Illinois Endangered Species Protection Board.

Two species of bats, the Indiana bat (*Myotis sodalis*) and gray bat (*Myotis grisescens*) are federally listed endangered species (50 CFR 17, subpart B, subsection 17.11). The Illinois Department of Transportation is required by the Endangered Species Act of 1973 [section 7(c), as amended] to assess potential adverse impacts to endangered species and their habitats, resulting from planned construction activities.

In conjunction with the proposed FAP 412 project, in which a four-lane limited access highway will be constructed between Normal, in McLean County, and Oglesby, in LaSalle County, the INHS was asked to conduct a limited survey and assessment of the local bat fauna. Data collected during assessments of threatened and endangered bat fauna include; environmental descriptions of project areas, lists of endangered and threatened species reported from or thought likely to occur there, and discussions concerning data collected during field investigations.

The biological inventory of bat fauna within the FAP 412 study area was focused upon selected sites on the Mackinaw River, McLean and Woodford counties, Illinois. Other riparian habitats likely to be affected by project construction [namely Six Mile Creek (McLean County); East Branch Panther Creek and Panther Creek (Woodford County); Bailey Creek (LaSalle County); Sandy Creek (Marshall County); and small nameless tributaries] were excluded from this particular assessment, because they were determined to be unsuitable habitats for bat fauna.

DESCRIPTION OF STUDY AREA

The FAP 412 study area occurs in the Grand Prairie Section of the Grand Prairie Natural Division (Schwegman 1973). Presettlement vegetation was largely tall-grass prairie, while forests occupied the river valleys and moraines (Mohlenbrock 1975).

The Mackinaw River is a westerly flowing tributary of the Illinois River, draining a large area of central Illinois. In general, today the forests along the Mackinaw River are confined to narrow riparian strips in the floodplain and on slopes adjacent to the river. Agricultural lands predominate beyond

the riparian forest strips and forested slopes. The vegetative analysis for four mist netting sites (Figure 1) located along the Mackinaw River, can be described as follows:

1) MRDS 6 Site, Woodford County
T25N, R1E, Section 1, SW-SE-NW-NE
(El Paso, Ill. 7.5' quadrangle)
Figure 2

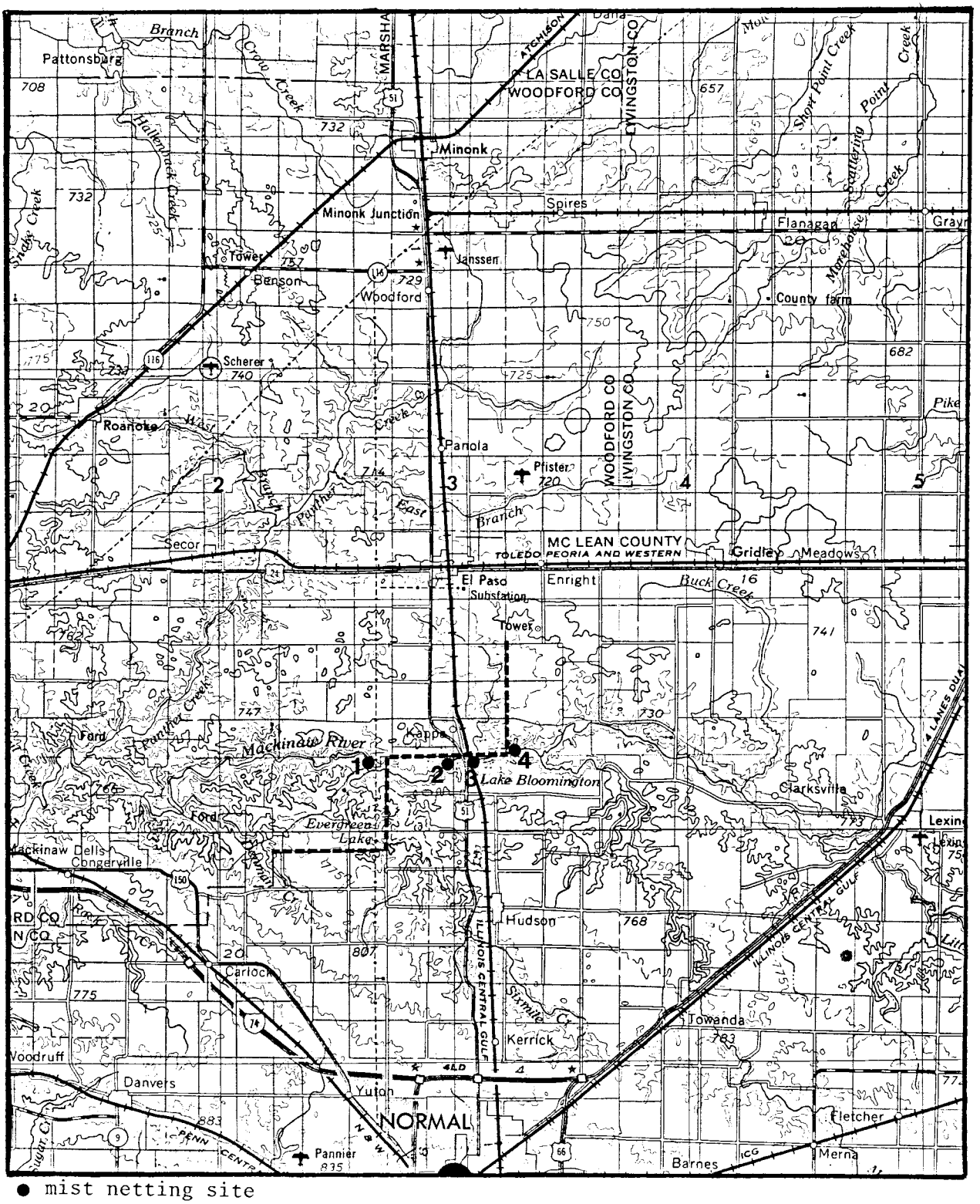
Vegetation along an approximate 400 m segment of the Mackinaw River was characterized. A young to mature (30 to 70 yrs. old) floodplain forest with scattered large trees borders the Mackinaw River and forms a category V (see Materials and Methods section for category description) corridor through most of the study area, with occasional segments of category III. This community is confined to a riparian strip on each bank, although it occupies a slightly broader area within a bend in the river on the west bank.

The dominant canopy tree is *Acer saccharinum* (silver maple), while common to occasional canopy species include *Juglans nigra* (black walnut), *Tilia americana* (basswood), *Fraxinus pennsylvanica* (green ash), *Platanus occidentalis* (sycamore), *Populus deltoides* (cottonwood), *Salix nigra* (black willow), and *Gleditsia triacanthos* (honey locust). The common subcanopy species include *Cercis canadensis* (redbud), *Acer negundo* (box elder), and *Ulmus rubra* (slippery elm). Occasional subcanopy species include *Celtis occidentalis* (hackberry), *Prunus serotina* (black cherry), *Salix nigra*, *Crataegus* sp. (hawthorn), and *Morus rubra* (red mulberry). Common shrubs and vines present include *Sambucus canadensis* (elderberry), *Ribes missouriense* (gooseberry), *Toxicodendron radicans* (poison ivy), *Parthenocissus quinquefolius* (Virginia creeper), *Smilax rotundifolia* (catbrier), and *Vitis* spp. (grape vines). The herbaceous understory was formed by dense colonies of *Laportea canadensis* (wood nettle), *Rudbeckia laciniata* (goldenglow), *Boehmaria cylindrica* (false nettle), *Phalaris arundinacea* (canary reed grass), *Elymus virginicus* (Virginia wild rye), *Lysimachia numularia* (moneywort), and *Rumex* sp. (dock).

A young to mature (30 to 50 yr. old) mesic upland forest occurs on a gentle SW facing slope on the east river bank in the northern quarter of the study area. This community is strongly dominated by *Juglans nigra* with common to occasional *Tilia americana*. *Cercis canadensis*, *Ulmus rubra*, and *Prunus serotina* form the subcanopy. The herbaceous understory includes *Polygonatum commutatum* (Solomon's seal), *Asarum canadense* (wild ginger), and *Glyceria striata* (fowl manna grass).

2) Golf Course Site, McLean County
T25N, R2E, Section 5, NE-NE-SE-NW
(El Paso, Ill. 7.5' quadrangle)
Figure 3

Vegetation along an approximate 500 m segment of the Mackinaw River was characterized. A young to mature wet-mesic floodplain forest with occasional large trees occurs as a riparian strip along both banks of the river. Beyond



● mist netting site

▬▬ county boundary

Figure 1. Location of four nist netting sites in the FAP 412 study area, Mackinaw River, McLean and Woodford counties, Illinois.

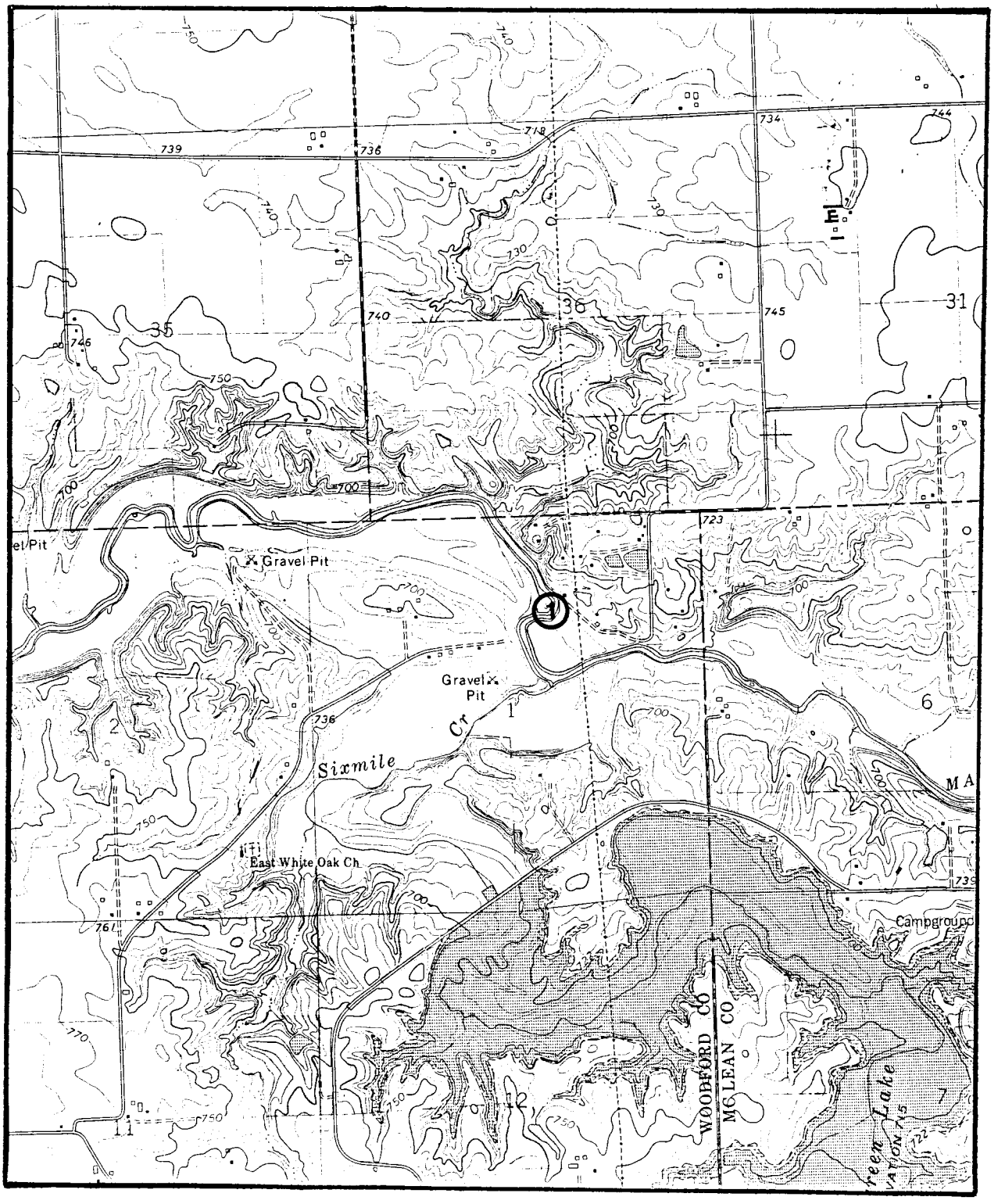


Figure 2. Location of MRDS 6 netting site, FAP 412 study area, Mackinaw River, Woodford County, Illinois.

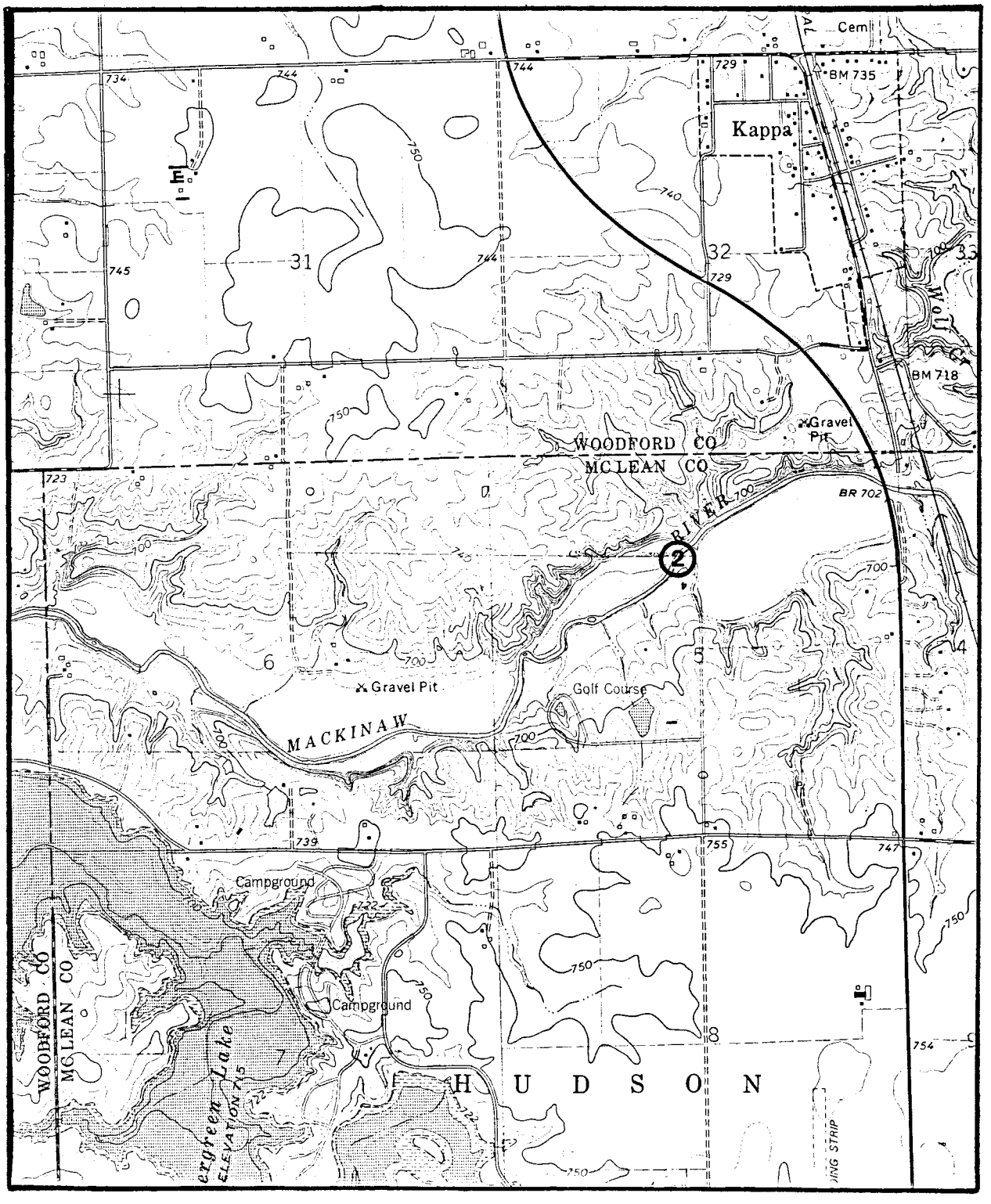


Figure 3. Location of Golf Course netting site, FAP 412 study area, Mackinaw River, McLean County, Illinois.

the riparian forest strip on the south bank lies a broad floodplain converted to cropland. A grazed young to mature mesic to dry-mesic upland forest occurs on a south facing slope beyond the riparian floodplain forest strip on the north bank.

The floodplain forest forms a category V corridor dominated principally by *Acer saccharinum* (silver maple). *Populus alba* (white poplar) is naturalized along the south bank and dominates a segment of the study area. *Fraxinus pennsylvanica* (green ash) is an occasional member of the canopy on both banks. *Gleditsia triacanthos* (honey locust), *Quercus macrocarpa* (bur oak), *Tilia americana* (basswood), and *Populus deltoides* (cottonwood) are occasional canopy members on the north bank only. The common subcanopy is formed by *Acer negundo* (box elder). Occasional subcanopy species include *Ulmus rubra* (slippery elm), *Celtis occidentalis* (hackberry), *Crataegus mollis* (red haw), *Prunus serotina* (black cherry), *Morus rubra* (red mulberry), *Staphlea trifolia* (bladdernut), *Euonymus atropurpureus* (wahoo), *Maclura pomifera* (osage orange), *Fraxinus pennsylvanica*, and *Acer saccharinum*. *Sambucus canadensis* (elderberry), *Ribes missouriense* (gooseberry), *Toxicodendron radicans* (poison ivy), and *Smilax rotundifolia* (catbrier) form the shrub and vine understory. The herbaceous understory includes *Elymus virginicus* (Virginia wild rye), *Osmorhiza claytoni* (Sweet cicely), *Cryptotaenia canadensis* (honewort), *Boehmaria cylindrica* (false nettle), *Laportea canadensis* (wood nettle), *Rudbeckia laciniata* (goldenglow), and *Ambrosia trifida* (giant ragweed).

In the upland forest community *Quercus macrocarpa* dominate the lower slopes while Quercus alba (white oak) and *Quercus rubra* (northern red oak) dominate the upper slope. *Quercus bicolor* (swamp white oak) is an occasional canopy species on the lower slopes. The common subcanopy includes *Fraxinus pennsylvanica*, *Prunus virginiana* (choke cherry), and *Celtis occidentalis*. Occasional subcanopy species include *Cercis canadensis* (redbud), *Cornus drummondii* (rough-leaved dogwood), *Viburnum prunifolium* (black haw), *Juglans nigra* (black walnut), *Ulmus rubra* (slippery elm), *Carya ovata* (shagbark hickory), and *Ptelea trifoliata* (wafer ash). *Toxicodendron radicans* and *Smilax* spp. are the common vines present.

3) MRC 5 Site, McLean County
T25N, R2E, Section 4, NW-SE-NW-NW
(El Paso, Ill. 7.5' quadrangle)
Figure 4

Vegetation along an approximate 400 m segment of the Mackinaw River was characterized. Floodplain forest occurs as a riparian strip along both banks of the river. Cropland occurs beyond this riparian forest strip in the floodplain north of the river, while mesic upland forest occurs on the northeast facing slope south of the river.

The riparian forest north of the river is a discontinuous, 1 to 5 m wide strip dominated by young *Acer saccharinum* (silver maple) with common to occasional *Acer negundo* (box elder) and *Ulmus rubra* (slippery elm). *Toxicodendron radicans* (poison ivy), *Rudbeckia laciniata* (goldenglow), *Boehmaria cylindrica* (false nettle), and *Ambrosia trifida* (giant ragweed) form the common understory. South of the river, the floodplain forest is mature (averaging 30

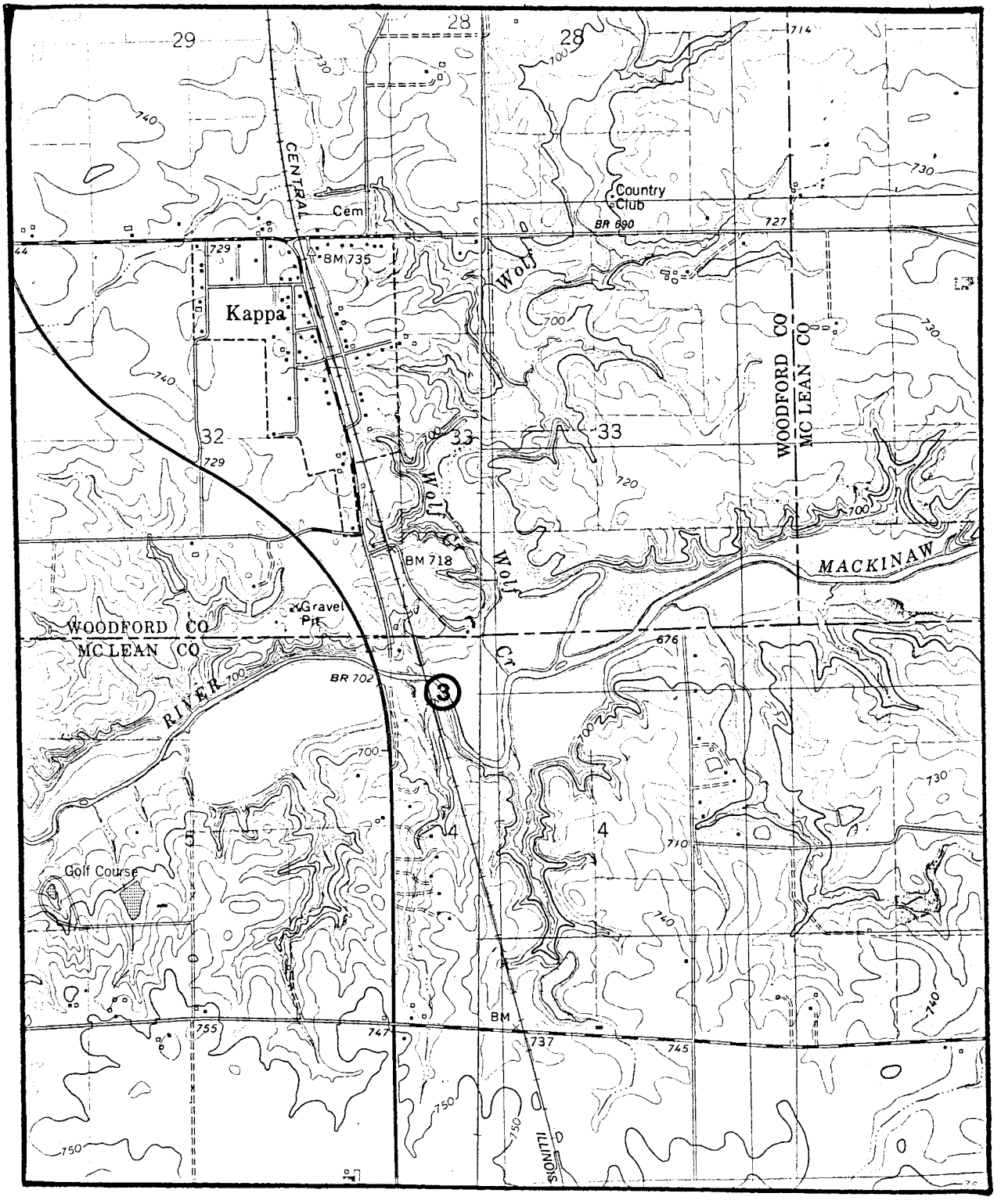


Figure 4. Location of MRC 5 netting site, FAP 412 study area, Mackinaw River, McLean County, Illinois.

to 46 cm dbh) with scattered large trees forming a category III corridor. The dominant canopy species is *Acer saccharinum* (occasional specimens up to 110 cm dbh) while *Populus deltoides* (cottonwood, up to 130 cm dbh), *Fraxinus pennsylvanica* (green ash) , *Juglans nigra* (black walnut), and *Platanus occidentalis* (sycamore) are common to occasional members of the canopy. The common to occasional subcanopy species are *Acer negundo, Fraxinus pennsylvanica, Staplea trifolia* (bladdernut), *Ulmus rubra,* and *Cornus drummondii* (rough-leaved dogwood) . Shrubs and vines present include *Euonymus atropurpureus* (wahoo), *Amorpha fruticosa* (false indigo), *Cephalanthus occidentalis* (buttonbush), *Sambucus canadensis* (elderberry), *Toxicodendron radicans* (poison ivy) , *Smilax rotundifolia* (catbrier), and *Vitis* sp. (grape). *Laportea canadensis* (wood nettle), *Rudbeckia laciniata, Boehmaria cylindrica,* and *Elymus virginicus* (Virginia wild rye) form the common herbaceous understory.

A young to mature mesic upland forest occurs on the northeast facing slope. The common canopy species include *Acer saccharum* (sugar maple), *Quercus rubra* (northern red oak), and *Tilia americana* (basswood) with occasional *Quercus macrocarpa* (bur oak). The subcanopy contains *Staphlea trifolia, Tilia americana, Ulmus rubra, Acer saccharum,* and *Carya cordiformis* (bitternut hickory).

Of special interest is a small hill prairie which persists on a narrow ridge above the northeast facing slope at the south end of this site. Although this community is small and has been somewhat degraded by invading forest species and weeds, forb diversity is high. Some of the forbs present include: *Echinacea pallida* (pale coneflower), *Comandra richardsiana* (false toadflax), *Solidago rigida* (stiff goldenrod), *Coreopsis tripteris* (tall tickseed), *Coreopsis palmata* (prairie Coreopsis), *Silphium terebinthinaceum* (prairie dock), *Amorpha canescens* (lead plant), *Polytaenia nuttallii* (prairie parsley), *Sisyrinchium campestre* (blue-eyed grass), *Lithospermum canescens* (hoary puccoon), *Ratibida pinnata* (yellow coneflower), *Euphorbia corollata* (flowering spurge), *Polygala senega* (seneca snakeroot), and *Tradescantia* sp. (spiderwort).

4) Koon's Ford Site, McLean County
T26N, R2E, Section 34, NE-SW-SW-SW
(Gridley, Ill. 7.5' quadrangle)
Figure 5

This netting site was located in a narrow strip of young to mature floodplain forest (mainly 30 to 90 years old) on the south bank of the Mackinaw River. *Acer saccharinum* (silver maple), is the dominant canopy tree along this category V corridor, with *Celtis occidentalis* (hackberry), *Fraxinus pennsylvanica* (green ash), *Juglans nigra* (black walnut), *Platanus occidentalis* (sycamore), *Populus deltoides* (cottonwood), and *Quercus macrocarpa* (burr oak) as occasional canopy trees. Occasional larger trees, ranging from 29 to 37 inches dbh, are present. The subcanopy is diverse, with common *Acer negundo* (box elder), *Acer saccharinum,* and *Morus rubra* (red mulberry), and occasional *Carya cordiformis* (bitternut hickory), *Carya ovata*

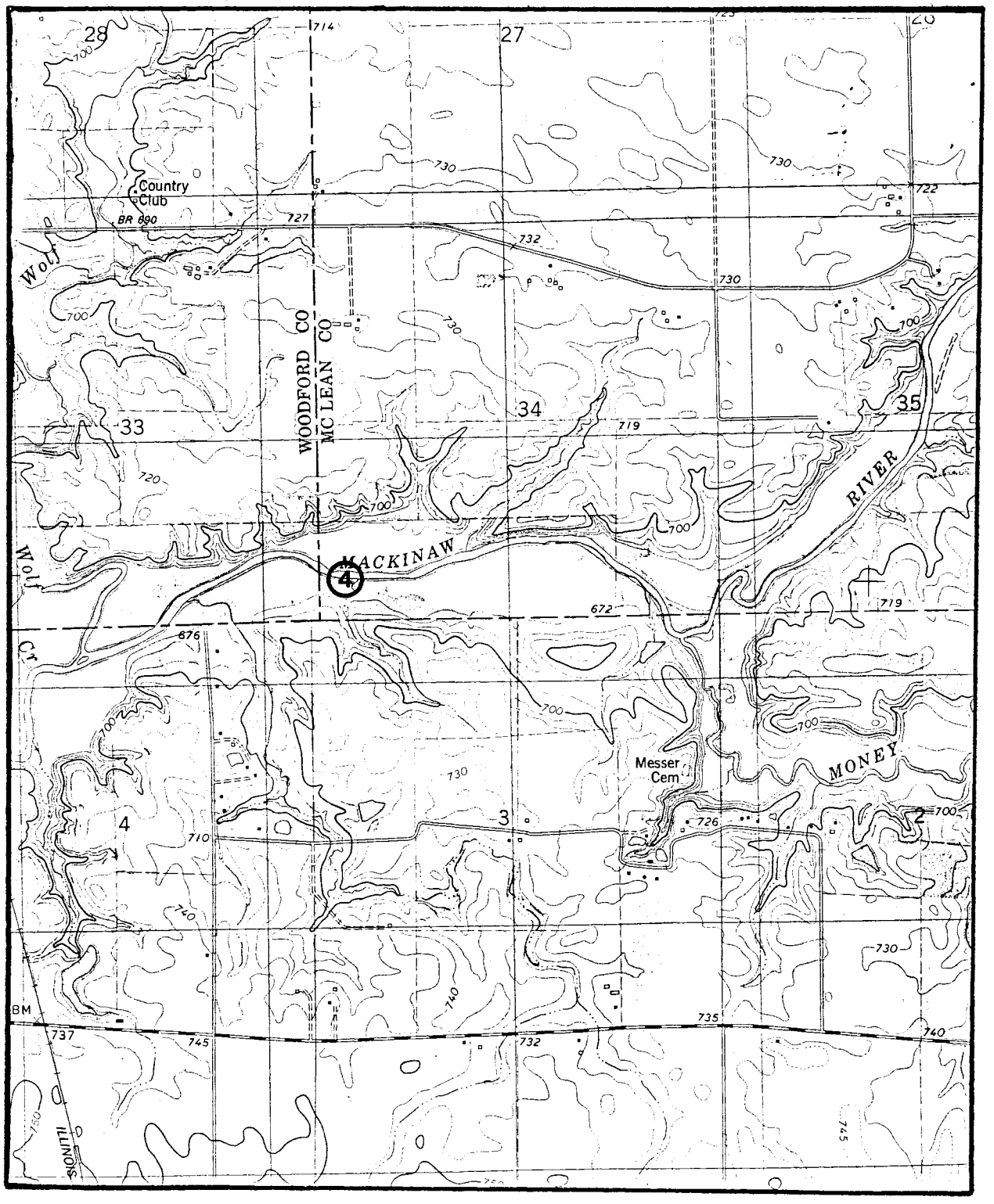


Figure 5. Location of Koon's Ford netting site, FAP 412 study area, Mackinaw River, McLean County, Illinois.

(shagbark hickory), *Fraxinus pennsylvanica*, *Maclura pomifera* (osage orange), *Morus alba* (white mulberry), *Prunus serotina* (wild black cherry), *Ulmus americana* American elm), and *Ulmus rubra* (slippery elm). Predominant shrubs and vines include: *Toxicodendrons radicans* (poison ivy), *Sambucus canadensis* (elderberry), *Smilax rotundifolia* (catbrier), and *Vitus* sp. (grape). The lush, dense groundcover is dominated by *Boehmeria cylindrica* (false nettle), *Laportea canadensis* (wood nettle), *Phalaris arundinacea* (reed canary grass), and *Rudbeckia lacinata* (goldenglow).

The west part of the netting site is located in primarily a regrowth to young (10 to 30 years old) woodlot, dominated by *Acer negundo*, *Juglans nigra*, *Maclura pomifera*, *Prunus serotina*, *Rhus glabra*, and *Ulmus rubra*.

MATERIALS AND METHODS

Vegetation Analysis

The aim of the vegetation analysis was to contribute data as an aid in determining summer habitat suitability for bat fauna. Past studies have shown that bats (particularly Indiana bats) forage for insects over riparian habitats (Humphrey *et al.* 1977; LaVal and LaVal 1980; Gardner and Gardner 1980; Gardner and Taft 1983, 1984), with a preference for contiguous woodlands and trees forming a canopy over streams and rivers. The Indiana Bat Recovery Team (USDI 1983) has established a category system which qualitatively rates riparian habitats in relation to their suitability for foraging Indiana bats (based on reported habitat preferences). This classification system was applied as follows:

Category I-Few or no trees on either bank.
II-Scattered small trees on either bank.
III-Mature trees on one bank only.
IV-Mature trees on both banks, but not extending past stream bank (not overhanging the stream).
V-Mature trees more than 3 meters past stream bank (overhanging the stream).

The vegetative communities along selected sites on the Mackinaw River were visually assessed by walking both upstream and downstream of the netting location until the community was adequately characterized to meet the study objectives. Each woodland community associated with the netting site was described (based on visual appraisal) of canopy and subcanopy in decreasing order of importance. In addition, the surrounding vegetation was briefly described.

Live Trapping Bats

Live trapping bats was accomplished by utilizing black, monofilament Japanese mist nets. These nets are 38 mm mesh and can be spread to a height of 2.2 m, and range in length from 9.1 m to 18.3 m. Pairs of 9.2 m or 6.2 m high interconnecting poles are used to position nets well above ground level. On

such high net sets, four mist nets of equal length are stacked vertically, one on top of the other, and suspended between pairs of poles by a rope and pulley system. The top of the uppermost net can be raised to a height of 6.2 m or 9.2 m and all nets can be lowered easily to retrieve bats. Whenever these nets are set over streams, areas are chosen where the trees create a complete, natural canopy. The nets are placed over the stream, perpendicular to the banks and immediately behind, or underneath, the canopy to create a netting plane between the water and tree canopy. Often, an additional net is placed near water level and adjacent to the high net set to completely close-off the flyway. The area covered by mist nets ranges from 117.12 square meters to 58.24 square meters, depending upon the length of nets and height of poles used. Nets are placed in the capture position at sunset and checked at maximum intervals of fifteen minutes until midnight, and usually later.

Data recorded for each bat capture included: species, sex, age (adult or immature), reproductive condition, weight, direction and height in the mist net, and capture time. Bats were captured, examined, and immediately released unharmed at site of capture. Environmental factors, such as sky condition, moon phase, temperature, and wind were used to assess bat activity and capture success. Age was determined by the degree of closure of the phalangeal epiphyses. Bats were designated as juvenile by their small overall size and incomplete ossification of the epiphyses.

Reproductive condition of males was determined by size and position of the epididymides. Scrotal bats were characterized by enlarged, or swollen, epididymides in pigmented sheaths dorsolateral to the tail. Enlarged testes usually accompany descended epididymides. Female bats were diagnosed as lactating, or post-lactating, on the basis of teat examination. Pregnant females were examined and their condition diagnosed by gently palpating the fetus through an obviously enlarged abdomen (care must be taken not to mistake a food-distended stomach for a fetus), or by body weights characteristic of pregnancy.

Observations of early foraging activity by bats were attempted at each netting locality. These observations provided valuable data on time of initial bat flight, as well as placement of bats in relation to the tree canopy when they first emerged. Foraging behavior of the bats can be observed in this manner, and can be used to aid in evaluations of capture success and significance of foraging areas. Observed bats are identified to genus (if possible) on the basis of size, flight activity patterns, and subsequent capture.

Potential roost trees were investigated and recorded within each study site. Trees were determined to offer adequate roosting sites for certain bat species based on their structural characteristics. Potential roost trees are usually mature (over 40cm dbh), with at least some senescent portions. Although den cavities provide an obvious access for bats into hollow bole portions, trees with exfoliating sheets of bark are considered to provide more favorable roost structures. The Indiana bat (*Myotis sodalis*) is known to establish maternity roosts beneath the loose bark of trees (Cope *et al.* 1978; Humphrey *et al.* 1977). Trees such as black locust (*Robinia pseudoacacia*) and shagbark hickory

(*Carya ovata*) produce long strips of loosened, but persistent, non-living bark. Cottonwood (*Populus deltoides*) predictably produces large and persistent sheets of bark because of its anatomical structure, offering excellent shelter to bats that may find their way beneath it (Gardner and Taft 1984).

RESULTS

1) MRDS 6 Site: Bat Survey Results and Stream Characteristics

This site was netted on 13 May 1985, and was located approximately 5.4 km downstream from the existing Rt. 51 bridge over the Mackinaw River (Figure 2). A high net set, using three 18.3 m mist nets, suspended between a pair of 9.2 m high poles, was postitioned over the river. The west pole was placed against a gently sloping mud bank, and beneath tall, mature sycamore. The east pole was positioned at the base of a steeply sloping mud bank covered with tree roots. Several mature silver maple overhung the netting pole with some longer branches overhanging the netting plane. In fact, many dominant canopy trees (silver maple, green ash, and sycamore) on opposing banks had branches which intertwined over the stream, creating the category V corridor. These areas were separated by areas of category III, creating openings in the canopy over the river.

The Mackinaw River, flowing from south to north at this site, created a slow riffle with pools above and below the netting site. The bottom was consolidated, with some submerged logs and other flood debris common. The riffle below the nets was gravel with silt components. Water quality appeared to be good in this area. Additional stream characteristics appear in Table 1 below:

Table 1. Vegetation classification and stream characteristics of netting site MRDS 6, FAP 412 study area, Woodford County, Illinois.

Vegetation Category	Width of Vegetation (m)		Stream Channel Characteristics				
	north	south	Width (m)	Depth (m)	Bottom Type	Riffle/Pool Frequency	Man-made Alterations
V	40	15	19+	0.3	mud	100 m+	none

Five potential roost trees were noted in this area. These trees included a silver maple with a hollow bole portion, which was being used by a female raccoon (*Procyon lotor*) as a maternity den. Several other silver maple snags occurred along this portion of the river, but they offered only poor potential as roost structures. None of the trees examined were found to be utilized by bats.

A single *Lasiurus cinereus* was captured and examined at this netting site Table 2). This female was captured at 2330 hrs. as she flew low above the river. No bats were observed in the vicinity of the netting site at sunset.

Climatological factors were characterized by 20 degrees C, and a waning moon in the last quarter had no noticable affect on bat activity. Thunderstorms approached the netting site from the southwest, but did not interfere with netting efforts.

Table 2. Bat capture data for MRDS 6 netting site, FAP 412 study area, Woodford County, Illinois.

Date	Location	County	Species	No.	Age	Sex	Rep. Cond.
05-13-85	Mackinaw River Site MRDS 6	Woodford	*Lasiurus cinereus*	1	A	F	Pg

M=male, F=female, A=adult, J=juvenile
Scr=scrotal, Pg=pregnant, L=lactating, PL=post lactating, NR=nonreproductive

2) Golf Course Site: Bat Survey Results and Stream Characteristics

This site was netted on 10 June 1985 and again on 12 June 1985. The site was located 30 m downstream from a concrete low-water bridge, found approximately 1 km downstream from the existing Rt. 51 bridge over the Mackinaw River (Figure 3). On both occasions, a high net set, using two 18.3 m mist nets, suspended between a pair of 6.2 m high poles, was positioned over the river. An additional 18.3 m mist net was placed parallel to the downstream side of the high net set, in order to completely close-off the flyway. The poles were placed beneath large, overhanging silver maples on opposing banks. The silver maple branches intertwined above the river, creating a closed-canopy area. The top line of the netting set touched the lower portions of the tree branches, creating an ideal capture situation. Even though the vegetation was limited to a narrow (often only one tree canopy width) strip along either bank, canopied portions of this category V netting site were common. The south bank of the netting site was characterized by a 3.5 m high steep mud bank with thick masses of roots. The north bank was equally as high, but sloped more gently to the river.

The Mackinaw River, flowing from northeast to southwest at this site, created a slow riffle beneath the netting plane. A long, calm pool occurred immediately above the nets and the low-water bridge. The bottom was silt and gravel, with some gravel bars along the banks. Riffles were more sandy/silty with little to nonexistant rubble. Water quality appeared good in this section. Additional stream characteristics are given in Table 3 below:

Table 3. Vegetation classification and stream characteristics of the Golf Course netting site, FAP 412 study area, McLean County, Illinois.

Vegetation Category	Width of Vegetation (m) north	south	Stream Channel Characteristics: Width (m)	Depth (m)	Bottom Type	Riffle/Pool Frequency	Man-made Alterations
V	8	8	17	0.2	silt/ rubble	40 m	concrete low-water bridge

Potential roost trees were investigated on both banks from the netting site upstream to the Rt. 51 bridge, and from the netting site downstream for approximately 800 meters. Many (7 to 9) good to excellent potential roost trees occurred within the 1 km segment between the netting site and Rt. 51 (from 18 trees examined). Only two potential roost trees were categorized as good in the 800 m segment examined below the netting site (from 12 trees examined). Some of the best potential roost trees occurred in the overgrown fencerow found immediately north of the concrete low-water bridge. None of the potential roost trees examined exhibited any evidence of utilization by bats.

A single bat was captured at this site, *Lasiurus borealis*, on 10 June (Table 4). This bat was captured at 2130 hrs. as she flew down the river. One bat was observed flying along the tree canopy on the north bank at 2100 hrs. During the 12 June netting night, three bats were captured. A female *L. borealis* was captured at 2130 hrs. as she flew downstream, and a male *Lasionycteris noctivagans* was captured at 2200 hrs. Another *L. borealis* was captured at 2215 hrs., but escaped before it could be completely examined. Again, only a single bat was observed on 12 June, flying along the treetops bordering the river.

Table 4. Bat capture data for Golf Course netting site, FAP 412 study area, McLean County, Illinois.

Date	Location	County	Species	No.	Age	Sex	Rep. Cond.
06-10-85	Mackinaw River Golf Course Site	McLean	*Lasiurus borealis*	1	A	F	L
06-12-85	Mackinaw River	"	*Lasiurus borealis*	1	A	F	L
			" "	1	-	-	-
			Lasionycteris noctivagans	1	A	M	Scr

M=male, F=female, A=adult, J=juvenile
Scr=scrotal, Pg=pregnant, L=lactating, PL=post lactating, NR=nonreproductive

Climatological data on 10 June was characterized by a partly cloudy sky and light breezes. The temperature at sunset was 21 degrees C, and dropped to 19 degrees C by 2400 hrs. During the netting period, the wind gusted slightly and thunderstorms appeared in the distance. The netting period was threatened with light rain for a short period. Light rain began at 2352 hrs. and became heavier much later in the morning. A waxing moon in the last quarter was obstructed by cloud cover. The weather on 12 June was characterized by a clear sky and a temperature change from 13 degrees C at sunset to 9 degrees C at 2400 hrs. The waxing moon did not appear until well after the netting period.

3) MRC 5 Site: Bat Survey Results and Stream Characteristics

Netting was attempted at this site on 14 May 1985, but was prohibited by thunderstorms and resultant heavy rains. However, the site was netted on the following night of 15 May. This site was located approximately 200 m upstream from the existing Rt. 51 bridge over the Mackinaw River, and approximately 50 m upstream from the abondoned Illinois Central railroad trestle over the river (Figure 4).

On both occasions, a high net set, using two 12.8 m mist nets suspended betwen 6.2 m high poles, was postitioned over the river. The south pole was placed at the base of a steep 3 m high mud bank and was overhung by a green ash. The north pole was positioned beneath overhanging silver maples at the base of an even steeper mud bank covered by flood debris. The green ash overhung the nets and the river, intertwineing with the branches of the silver maples on the opposing bank to create a completely closed canopy area over the river. In fact, the top line of the high net set touched the canopy created by these trees.

The Mackinaw River, flowing from southeast to northwest beneath the nets, created a slow-flowing pool. Some submerged roots and logs extended above the water level. Long, calm pools were characteristic of the river above and below the netting site. The bottom was primarily firm mud, with no rubble observed. Water quality appeared to be good here with a number of aquatic related organisms collected from the site. Table 5 represents additional data on stream characteristics.

Table 5. Vegetation classification and stream characteristics of the MRC5 netting site, FAP 412 study area, McLean County, Illinois.

Vegetation Category	Width of Vegetation (m) north	south	Stream Channel Characteristics: Width (m)	Depth (m)	Bottom Type	Riffle/Pool Frequency	Man-made Alterations
III	6	50+	12	0.5	mud	100 m+	railroad trestle 50 m downstream

Thirteen potential roost trees were examined along both banks from the Rt. 51 bridge to a point approximately 600 m upstream from the netting site. Of the trees examined, only three exhibited good potential as roost structures. None of the trees examined exhibited any evidence of utilization by bats.

Bats were neither captured at this site, nor were they observed flying at sunset on either date. Even though heavy rains prohibited netting on 14 May, bats were not observed at sunset (2105 hrs.) and none were captured before 2210 hrs. (when rain began). On 15 May, no bats were seen and none were captured, even though the sky was clear and conditions for bat activity were favorable. During this net night, the temperature was 15° C at sunset, and dropped only 4° C by 2400 hrs.

4) Koon's Ford Site: Bat Survey Results and Stream Characteristics

This site was netted on 13 June 1985, and was located approximately 2.5 km upstream from the existing Rt. 51 bridge over the Mackinaw River (Figure 5). A low-water farm ford exists across the river at this location.

A high net set, using three 18.3 m mist nets suspended between 9.2 m high poles, was positioned over the river. The north pole was placed at the base of a 2 m high mud bank, beneath a large overhanging silver maple. The south pole had to be placed 2.5 m out from the steep bank, because of excessive stream width. Two large silver maples overhung this pole slightly. The stream was far too wide at this site to allow canopy formation. However, silver maple overhung the north pole, creating a partial canopy over the nets.

The Mackinaw River, flowing from east to west beneath the nets, created a fast riffle, split into two almost equal portions by a rubble island. A long, calm pool occurred above the net site, but was too deep to allow netting. The bottom at this site was heavily strewn with rubble and logs and other flood debris. See Table 6 for additional stream characteristics, .

Table 6. Vegetation classification and stream characteristics of the Koon's Ford netting site, FAP 412 study area, McLean County, Illinois.

Vegetation Category	Width of Vegetation (m) north	south	Stream Channel Characteristics: Width (m)	Depth (m)	Bottom Type	Riffle/Pool Frequency	Man-made Alterations
V	8	50+	22	0.2	rubble	100 m+	low-water farm ford across river

Potential roost trees were examined for approximately 1.1 km downstream from the netting site. Twenty-one trees were discovered and investigated, but only 8 trees were determined to exhibit good potential as roost structures. None of these trees exhibited any evidence of utilization by bats.

A single bat was captured at this site, a lactating *Myotis keenii* (Table 7). This bat was captured at 2230 hrs. as she flew downstream. One bat was observed at 2104 hrs. (sunset). Climatological factors were characterized by a completely clear sky, and a temperature at sunset of 17 degrees C. The temperature dropped to only 15 degrees C by 2400 hrs. A waxing moon to a nearly full stage did not affect netting conditions, due to its appearance well after netting had ceased.

Table 7. Bat capture data for Koon's Ford netting site, FAP 412 study area, McLean County, Illinois.

Date	Location	County	Species	No.	Age	Sex	Rep. Cond.
06-13-85	Mackinaw River	"	*Myotis keenii*	1	A	F	L

M=male, F=female, A=adult, J=juvenile
Scr=scrotal, Pg=pregnant, L=lactating, PL=post lactating, NR=nonreproductive

DISCUSSION

Historical Records

The historical perspective concerning bat fauna inhabiting the FAP 412 study area is rather inadequate. Only three species of bats have been previously recorded from McLean, Woodford, Tazewell and Livingston counties. This region of central Illinois is an extensively agriculturalized one, and habitats that may support bat fauna are very limited in quantity and quality. A summary of unpublished records from the Illinois Natural History Survey and Illinois Department of Conservation are included in Table 8 below.

Table 8. Records of occurrence of bat fauna from the FAP 412 study area, McLean, Woodford, and adjacent counties, Illinois.

Species	Location	County
Lasiurus borealis	Pekin, IL.	Tazewell
" "	Normal, IL.	McLean
Eptesicus fuscus	El Paso, IL.	Woodford
" "	Normal, IL.	McLean
Lasionycteris noctivagans	3 miles south Chenoa, IL.	McLean
" "	ISU, Normal, IL. campus	"
" "	Pontiac, IL.	Livingston

The largest known hibernaculum for bats in Illinois occurs approximately 75 km north of the Mackinaw River, in an abandoned mine system. A census of the hibernating populations of bats was conducted on 14 February 1985, in conjunction with the assessment of local bat fauna in the FAP 412 study area. A hibernating population of approximately 200 *Myotis sodalis* was censused on that date. This population represents the nearest reported occurrence of Indiana bats to the project area. The summer distribution pattern for this winter colony is not known, but it is highly probable that they may at some time utilize specific areas of the Mackinaw River, especially during summer migration from the hibernaculum.

Federal and State Endangered Chiroptera in Illinois

Fourteen species of bats have been historically reported from Illinois, but only eleven species are encountered with any regularity. Although any of these eleven species may possibly be encountered in caves, or mines, seven species are catagorized as cave bats. Cave bats make regular use of and are dependent upon caves (or mines) during all or part of their life cycle. The other four species are catagorized as tree bats, because most migrate as an alternative to hibernation. Morphological, physiological, and social variations are used to differentiate cave bats from tree bats.

All species of bats occurring in Illinois are protected by law (Illinois Wildlife Code, as revised, Chapter 61, Article II, section 2.2), with the Indiana bat and gray bat listed as state endangered. These endangered species of bats are seriously threatened by human activities. Alteration and destruction of habitat resulting from stream channelization, lake inundation, agricultural land clearing, road and utility construction, urban expansions, and a host of other "progress" related developments all threaten the continued existence of gray and Indiana bat populations. Natural history accounts for these two species appear below, in an attempt to more fully describe their habitat requirements. Although loss of habitat has assuredly affected other species of bats, most appear to be surviving successfully.

Myotis sodalis - Indiana Bat

Myotis sodalis is a highly migratory species, widely distributed in summer, but more concentrated in caves during winter hibernation. The range of the species includes most of the eastern United States, being closely associated with major cave regions and areas north of these regions (Hall 1981). Approximately 66% of the known population (or about 350,000 bats) hibernate in a few caves and one abandoned mine in Missouri (LaVal and LaVal 1980; Schwartz and Schwartz 1981). The remaining one third of the population hibernates primarily in one cave in Indiana and one in Kentucky.

A great deal less information is known concerning *Myotis sodalis* summer distribution within its range. Recaptures of banded bats have documented summer migrations northwest from Kentucky hibernacula into Indiana, Ohio, and Michigan (Barbour and Davis 1969). Banded female and juvenile Indiana bats from Missouri hibernacula were recaptured throughout northern Missouri, and one record is from Iowa (LaVal and LaVal 1980; J. B. Bowles, pers. comm.). Records of *Myotis sodalis* in extreme southern and west-central Illinois suggest additional movements southeast, east, and northeast from Missouri hibernacula (Brack 1979; Thom 1981; Gardner and Taft 1983, 1984). Additionally, Indiana bats hibernating in north-central Illinois should characteristically migrate into northern Illinois and possibly as far north as Wisconsin.

Very little information concerning *Myotis sodalis* summer habitat requirements is known. However, floodplains and their associated riparian vegetation are considered the most valuable land in the summer range of the species (Humphrey *et al.* 1977; USDI 1983). Until recently, summer records of *Myotis sodalis* were sparse and scattered. Immature males have been captured from beneath a

concrete bridge and beneath the bark of an old, dead tree (Mumford and Cope 1958). [An immature *Myotis sodalis* reported from a house by Mumford and Cope (1958) was incorrectly identified (Humphrey *et al.* 1977).] In Illinois, Indiana, and Missouri, juvenile and pregnant and lactating female *Myotis sodalis* have been reported flying along woodlot borders, and over lakes (Mumford and Cope 1958; Mumford and Calvert 1960; Easterla and Watkins 1969). LaVal and LaVal (1980) reported capturing a few lactating females and juveniles most often over streams in northern Missouri. The streams were characterized by thin strips of riparian vegetation with adjacent croplands. Juveniles and adult females were captured over and near the Kankakee River in extreme northwest Indiana (Brack and Holmes 1982). Summer populations in other areas of Indiana have been well documented (Cope *et al.* 1974; Humphrey *et al.* 1977).

In Illinois, *Myotis sodalis* distribution records are reported from throughout the state, but in most cases, probably more closely illustrate individual records and areas that have been selectively sampled rather than meaningful population structures. Juvenile and reproductively active adult female *Myotis sodalis* have been reported from Jackson, Perry, Pike, Union, and Wabash/Edwards counties in Illinois (Brack 1979; Sparling *et al.* 1979; Gardner and Gardner 1980; Kessler and Turner 1980; Kirkpatrick 1980; Dunstan and Warnock 1981; Gardner and Taft 1984). Additional Illinois records for the Indiana bat include Christian, Cook, Hardin, McDonough, and Morgan counties (Dunstan and Warnock 1981; Thom 1981; Gardner and Taft 1983, 1984; Unpublished records, Illinois Department of Conservation). LaSalle County records represent one of few remaining Illinois hibernacula for *Myotis sodalis*. One cave in Monroe County may be more significant to hibernating Indiana bats than was previously believed. In addition, the Madison County record is from a cave and the JoDaviess County record is a winter record over 30 years old.

Only in Indiana have any maternity roosts of *Myotis sodalis* been discovered. The first reported nursery colony was discovered when a dead American elm (*Ulmus americana*) was destroyed by a bulldozer (Cope *et al.* 1974). Fortunately, the colony re-established itself in the area in a dead bitternut hickory (*Carya cardiformis*), but was not discovered until a few years later (Humphrey *et al.* 1977). The authors also reported that the colony was utilizing the naturally exfoliating bark of a living shagbark hickory (*Carya ovata*) as an alternative roosting place. Observations and ecological studies of the maternity population by Humphrey *et al.* (1977), indicated that foraging habitat of the 50 individuals was confined to the foliage of riparian floodplain trees. They found that bats flew within an air space from 2 to 30 m high along a linear strip of creek vegetation 0.82 km in length. The foraging area was found to include 1.47 ha in early summer, but expanded to 4.54 ha in mid-summer.

Cope *et al.* (1978) reported netting bats from at least two maternity populations of *Myotis sodalis* along the Big Blue River in east-central Indiana. They reported a foraging area of 1.2 km in length for one colony studied. Foraging Indiana bats flew over the wooded river, or around the riverside trees (Cope *et al.* 1978). They reported colony sizes of 100 and 91 individuals respectively, including adult female and juvenile bats (colony

size was estimated, based on netting success). Both colonies utilized an area of the river that Cope *et al.* (1978) classified as excellent habitat (more than 30 m of woody vegetation on both sides of the stream).

The highly gregarious habits of *Myotis sodalis* during hibernation has contributed greatly to its vulnerability. Flooding (Hall 1962), ceiling collapses (Hall 1962; Brady 1982), and freezing (Humphrey 1978) are all natural disasters responsible for population declines. However, the single most serious cause of decline in *Myotis sodalis* is human disturbance and vandalism in the hibernacula (USDI 1983). Humphrey (1978) reported that Indiana bat populations have declined nationwide in numbers by 28% between 1960 and 1975, with the most drastic reduction (by as much as 75%) having occurred in Kentucky. He also reported that Illinois winter populations of Indiana bats have been reduced by 42.8% during the same time period.

Other factors contributing to the decline of the species, include stream channelization, deforestation and pesticide poisoning. Conlin (1976) reported that 29.7% of the interior streams (or 5,566 km) in Illinois had been channelized by 1976. Deforestation by agricultural practices, road construction, urban expansions, and a host of "progress" related developments all adversely impact the continued existence of *Myotis sodalis*. Pesticide induced mortality of insectivorous bats has been well documented (Geluso *et al.* 1976; Clark *et al.* 1983), and has possibly contributed to declining populations of *Myotis sodalis*. There are many unanswered questions about the possible impact of water quality deterioration and food availability, which may have even more adverse impacts on *Myotis sodalis* populations.

Myotis grisescens - Gray bat

The gray bat is a highly migratory, social species which establishes nursery colonies in caves during summer, and hibernates in different caves during the winter. The range of the species is closely associated with major cave regions of the eastern United States, extending from eastern Tennessee and Kentucky through extreme southern Indiana, and southern Illinois. This range includes practically all of Missouri, southeast Kansas, northeast Oklahoma, and northern Arkansas. A southern extension of the range includes most of Alabama as far south as northwest Florida, and portions of northwest Georgia and northeast Mississippi (Hall 1981).

Studies of *Myotis grisescens* populations in Alabama and Tennessee showed that numbers had decreased 47% by the year 1970, and had decreased by an additional 54% six years later (Tuttle 1979). Due to increased longevity, population levels may appear to remain stable for a few years, even though young may not have been sucessfully reared during that time (Tuttle 1979). Populations in Missouri may have been reduced 72% to 81% over the past 50 years. Of 27 known maternity caves in Missouri, at least 16 have been abandoned (LaVal and LaVal 1980). Such a high rate of decline is evident for one Illinois population of *Myotis grisescens*, having been reduced by at least 80% over the last 28 years (Hall and Wilson 1966). There is substantial evidence to indicate that this Illinois population may no longer exist.

Loyalty to hibernacula and maternity caves has been reported to be strong (LaVal and LaVal 1980; Myers 1964; Tuttle 1976). Gray bats establish nursery colonies in suitable caves from mid-April to September, most often migrating to a different cave to hibernate. Movements of *Myotis grisescens* from a hibernacula in Shannon County, Missouri, to a transient cave in Pike County, Illinois, have been documented (Kerr 1973). However, because the species is completely dependent upon caves, it never has been well known in Illinois.

In Illinois, *Myotis grisescens* once was common in a cave near Rosiclare, in Hardin County (Cory 1912; Whitaker 1975). Movements of this colony (reported as a nursery colony) was studied by Hall and Wilson (1966). Although their sample size was small, they recaptured some banded bats at Coach-James Cave (a large hibernacula for gray bats) in Kentucky. The occurrence of gray bats elsewhere in Illinois is sporadic at best, but they have been found using a few small caves and mines as transient sites, in Pike and Adams counties (Kerr 1973; Skaggs 1973; Thom 1981; unpublished data, Illinois Department of Conservation). Other records are of individuals taken from a cave and a sewer in Jersey and Madison counties respectively (Thom 1981). There are no known hibernacula for *Myotis grisescens* in Illinois, although solitary gray bats may be infrequently encountered in caves or mines.

Gray bats establish nursery colonies, sometimes numbering thousands of individuals, in caves meeting very narrow microclimate requirements. Copulation occurs during the fall, with sperm stored by the female through hibernation (delayed fertilization). In Missouri, colonies of pregnant females began to form in early April and they foraged over Ozark streams or lakes in thevicinity of the cave. Males and non-reproductive females form "bachelor" colonies in other caves (usually nearby), and are virtually absent from maternity roosts. A single young is born sometime during June, and is capable of leaving the cave by late July (LaVal and LaVal 1980).

By late September, gray bats begin arriving at hibernacula (those few caves meeting very narrow microclimate requirements). Both sexes congregate in the hibernacula after swarming behavior (copulation occurs primarily during swarming). In Missouri, females congregated in increasing numbers at major transient caves during September, and most had moved to more southern hibernacula by the end of the month. Males remained in the summer colony area during October, gradually moving south to hibernacula by early November (LaVal and LaVal 1980). This delayed timing increases the potential for males to copulate with females as they arrive at transient caves and hibernacula.

Myotis grisescens forage almost exclusively over rivers, streams, and lakes within 2 km of their cave (LaVal *et al.* 1977; LaVal and LaVal 1980; Tuttle 1976). In Missouri, aquatic insects are predominant sources of food, when they are available. Beetles, particularly species most abundant in forested cliffs along rivers, become an important food source in late summer (Schwartz and Schwartz 1981).

Gray bats are especially vulnerable to human-induced mortality, primarily due to juvenile death by disturbance at nursery caves. When female gray bats with young are frightened by cave visitors, they often panic and drop their young to the cave floor, or guano pile. Once a young, non-volant bat has fallen to the floor, its chances of survival are practically nonexistent. Other factors

contributing to the decline of the species include natural disasters (e.g. flooding, freezing, and collapse of mines or caves), disturbances at hibernacula, stream channelization, deforestation, and pesticide poisoning (Clark *et al.* 1978, 1983; Tuttle 1979).

Sampling Biases

Mist netting remains the only technique presently available which provides the means to capture bats unharmed, at locations other than cave entrances. There are many biases associated with this technique, and some questions may be raised concerning its effectiveness.

It is obvious that mist netting over a stream yields a biased sample, because those species of bats that forage over streams would more likely be caught than species which use streams as flyways, or only come to drink. Therefore, bats that forage and drink elsewhere are less likely to be captured. Additionally, nets would have to be positioned within a colony's foraging range in order to caspture the bats. Ideally, nets should not be placed over one kilometer apart in any given stretch of stream, to adequately sample the area for populations of *Myotis sodalis* [based on known foraging ranges for the species determined by Humphrey *et al.* (1977) and Cope *et al.* (1978)].

Some special considerations involve the use of mist nets to capture *Myotis sodalis*. Indiana bats are commonly observed foraging at dusk, well above ground level, but forage gradually lower as the night progresses. It has been well documented that *Myotis sodalis* forages around tree crowns, so nets should be set high above the ground level in spaces bounded by tree canopy. However, Humphrey *et al.* (1977) remarked that single aerial nets set high in foraging areas never captured this species. They further reported observing bats foraging from 2 m to 30 m above ground level. Indiana bats have been captured from pond level (Easterla and Watkins 1969) to more than six meters high (Brack and Holmes 1982). Gardner and Gardner (1980) captured 14 *Myotis sodalis* between 2 m and 6.4 m above stream level, with the majority captured in an open, uncanopied area of the stream, a few meters from a highway bridge in a small town. Gardner and Taft (1983) captured an adult male Indiana bat at a height of only 1.5 m above the stream, and females have been captured at heights of one meter and less (J. E. Gardner, unpbl. data).

Another bias associated with mist netting is the duration of netting night. The widely accepted period of adequate sampling is from sunset until midnight. *Myotis sodalis* is known to spend at least the first half hour after dusk foraging in the vicinity of their diurnal roost (Humphrey *et al.* 1977). High forage nets set in appropriate habitat, and attended for three hours after sunset should be sufficient time to capture them. Gardner and Gardner (1980) captured thirteen of fourteen Indiana bats on or before 2400 hrs. However, Brack and Holmes (1982) reported capturing a significant number of *Myotis sodalis* several hours after midnight, with a lactating female captured at 0120 hrs. Cope *et al.* (1978) reported capturing two lactating adult female Indiana bats after 2400 hrs., offering as an explanation the remoteness of the colony to the netting site. Several *Myotis sodalis* have been captured immediately after dusk and were the first bats captured (J. E. Gardner, unpubl. data).

Captures of Indiana bats well after midnight in late summer, when their foraging ranges have been extended, could be explained by time displacement (Humphrey *et al.* 1977).

Perhaps the single most obvious bias of mist netting is the selectivity of the area to be sampled. Sampling is often limited to a narrow band of habitat to be affected by construction activities. Therefore, efforts to best evaluate any potential detrimental effects from such construction is focused upon these narrow areas.

It is extremely difficult, if not unreasonable, to expect to prove the presence or absence of a particular species of bat by mist netting. Mist netting techniques do not ensure the capture of every bat in any given area. However, capture success from mist netting (when conducted correctly) provides the best indication of species occurrence by means presently available to researchers. Species variation in habitat utilization, by factors such as spacial distribution, has been illustrated for several species of bats (Barbour and Davis 1969). The fact that Indiana bats may utilize habitat types in Illinois other than those previously reported and generally accepted as "important" to the species, illustrates the necessity to consider all habitats in evaluating possible impacts to *Myotis sodalis* populations. Captures of an individual Indiana bat in a particular area cannot be fully explained by a single night of sampling. There are still insufficient amounts of information concerning the natural history of this species to determine the significance of such captures.

Elements of Quality Bat Habitat

Although the Indiana/Gray Bat Recovery Team has established categories which describe habitat suitability for Indiana bats, additional comments can be made regarding generally suitable bat habitat. Essential elements of minimal bat habitat include a combination of foraging areas, available water, and roost structure availability. The potential for quality habitat is improved if contiguous, primarily mature forested areas are found in conjunction with an unpolluted watercourse, diversity of roost structure, and unobstructed flyways for dispersal from diurnal roosts. Conversely, habitats are not as suitable for bats for one or more of the following reasons: inadequate water source, lack of potential foraging areas, congested or non-existent flyways, lack of suitable roosting structures, and the occurrence of highly disturbed habitats in urban areas.

Predominantly mature forested areas generally include dead and dying trees, which provide good potential roost structures. Floodplain forest trees such as cottonwood, shagbark hickory, black locust, and sometimes silver maple may provide some of the best potential roost structures in Illinois (Gardner and Taft 1984).

Streams containing calm pools, or isolated ponds are generally preferred drinking sites for bats. The quality, as well as quantity of water is often directly related to the availability of insect prey items. Watercourses are not only utilized as foraging areas, but may serve as avenues of dispersal and migration.

It is extremely important to understand that finding no evidence of bats roosting in a particular tree one year does not eliminate the possibility that bats may utilize that same tree in following years. For this reason, trees exhibiting the best potential as roosting structures, in any given area, should not be disturbed or destroyed from May 1 through August 15. It is during this critical period that *Myotis sodalis* establishes nursery colonies and rear their young. It should also be noted here that ground level investigations of potential roost trees may not be sufficient to discover bat colonies which may be well concealed beneath the bark or in hollow bole portions of trees.

Federal and State Endangered Chiroptera in the FAP 412 Study Area

The FAP 412 project area falls well within the recorded range of *Myotis sodalis*, and habitats present along the section of the Mackinaw River study area appear suitable for this species. Therefore, the Indiana bat received the utmost attention in assessment efforts. However, *Myotis grisescens* has been neither historically reported from the study area, nor is it likely to occur there, due to lack of prefered habitat (primarily caves). Therefore, assessments for gray bats were not a primary focus of this study.

Considering the previously defined elements of quality bat habitat, the Mackinaw River in the FAP 412 study area is suitable habitat for *Myotis sodalis*. However, the study sites cannot be construed as high quality habitat, for reasons discussed in detail as follows:

> Diversity of Roost Structures: Sixty-nine potential roost trees were discovered and examined at four netting sites along the Mackinaw River. Collectively, there was sufficient number of these dead, or dying, trees with loose and peeling bark to provide roost structures for bats (particularly *Myotis sodalis*). Additionally, there appeared to be sufficient quantities of dead and dying trees that should provide potential roost structures in the future. Although sufficient quantities of potential tree roosts occur within the study area, the lack of alternate roost structures (e.g. cliffs, crevices and caves) detract from the maximum habitat potential. None of the trees examined during this study were found to exhibit evidence of utilization by any species of bats.
>
> Contiguous Mature Forests: As stated earlier, the forests along the Mackinaw River are confined to narrow riparian strips in the floodplain and on slopes adjacent to the river. Cropland predominates beyond the riparian forest strips and forested slopes. The elimination of suitable habitat for bats increases the interspecific competition for life requirements (e.g. foraging space, prey availability, and roost structure). Those species which can adapt more readily and compete more successfully with limited resources will prevail (e.g. *Lasiurus borealis*).

Pesticide Contamination: Although direct evidence of pesticide poisoning has not been documented for the FAP 412 study area, it is highly suspected as a detrimental factor to local bat populations. Reports of "dumping" materials (including pesticides) from aircraft sprayers directly above the Mackinaw River corridor were encountered during interviews with local residents. Long term contamination through ingestion of pesticide-laden insects is a known mortality factor in bats. The direct ingestion of pesticides by grooming of contaminated body parts, exposed through "dumping", would more directly induce mortality. This speculation is supported in part by the lack of herpetile populations in the study area, with pesticide poisoning being the suspected cause (C. H. Perino, pers. comm.).

With respect to historical records, habitat evaluations, and bat capture results, it is reasonable to assume that populations of *Myotis sodalis* or *Myotis grisescens* did not exist within the segment of the Mackinaw River studied during 1985. However, there is a definate possibility that *Myotis sodalis* could utilize portions of habitats along the Mackinaw River, but not necessarily within the study area.

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